Amendments to the Claims

1. (Previously Presented) A search method for identifying one or more candidate delays for a receiver comprising:

receiving a signal having one or more signal images, each signal image having a corresponding signal delay;

generating a hierarchical delay tree for the received signal comprising a plurality of delay nodes in a lowermost level of the delay tree linked by branches and one or more linking nodes to a root node at the highest level of the delay tree, wherein each delay node is associated with one of the signal delays;

searching through the delay tree to identify one or more surviving delay nodes, wherein searching comprises traversing downward through the delay tree and identifying one or more surviving nodes at each level during said downward traversal by comparing a value associated with each node traversed with a predetermined threshold; and

selecting one or more surviving delay nodes as the candidate delays.

2. Cancel

3. (Previously Presented) The search method of claim 1 further comprising:

identifying non-surviving nodes at each level of the delay tree below the root node; and

deleting subtrees depending from the non-surviving nodes such that the subsequent searches through the lower levels of the delay tree do not include the deleted subtrees.

4. (Previously Presented) The search method of claim 1 wherein the predetermined threshold comprises a level-specific threshold for each level of the delay tree.

5. (Previously Presented) The method of claim 1 wherein searching through the delay tree to identify one or more surviving delay nodes further comprises repetitively searching through the delay tree until a desired number of candidates delays are identified.

6. (Previously Presented) The method if claim 5 wherein repetitively searching through the delay tree until a desired number of candidates delays are identified further comprises increasing the predetermined threshold in a repeat search relative to an initial search to reduce the number of candidate delays identified.

7. (Original) The method of claim 6 wherein repetitively searching through the delay tree until a desired number of candidates delays are identified further comprises limiting the repeat search to subtrees depending from surviving nodes in the previous search.

8. (Previously Presented) The method of claim 5 wherein repetitively searching through the delay tree until a desired number of candidates delays are identified further comprises decreasing the predetermined threshold in a repeat search relative to an initial search to increase the number of candidate delays identified.

9. (Original) The method of claim 8 wherein repetitively searching through the delay tree until a desired number of candidates delays are identified further comprises limiting the repeat search to subtrees depending from non-surviving nodes in the previous search.

10. (Original) The search method of claim 1 further comprising inputting the candidate delays corresponding to the surviving delay nodes into a state machine, said state machine comprising a plurality of ordered states including a start state, a steady state, and an exit state.

11. (Original) The search method of claim 10 further comprising assigning one or more candidate delays in one or more states of the state machine to a demodulator.

12. (Original) The search method of claim 10 further comprising promoting and demoting candidate delays present in the state machine responsive to the results of searching through the delay tree.

13. (Original) The search method of claim 12 wherein promoting and demoting candidate delays present in the state machine responsive to the results of searching through the delay tree comprises promoting candidate delays present in the state machine from a first state to a second state when the candidate delay corresponds to a surviving delay node.

14. (Original) The search method of claim 12 wherein promoting and demoting candidate delays present in the state machine responsive to the results of searching through the delay tree comprises demoting candidate delays present in the state machine from a first state to a second state when the candidate delay corresponds to a non-surviving delay node.

15. (Original) The search method of claim 10 further comprising deleting one or more candidate from the exit state of the state machine responsive to the results of searching through the delay tree.

16. (Original) The search method of claim 1 wherein generating a hierarchical delay tree comprises:

determining a signal characteristic for one or more signal delays;

assigning a value based on the signal characteristics to the delay nodes;

assigning a value to each linking node equal to the sum of the nodes in the next lower level connected by branches to the linking node; and

assigning a value to the root node equal to the sum of the linking nodes at the level below the root node connected by branches to the root node.

17. (Original) The search method of claim 16 wherein determining the signal characteristic for the one or more signal delays comprises determining a signal energy associated with each of the one or more signal delays.

18. (Original) The search method of claim 16 wherein determining the signal characteristic for the one or more signal delays comprises determining a signal-to-noise ratio associated with each of the one or more signal delays.

19. (Original) The search method of claim 1 wherein generating a hierarchical delay tree comprises generating a binary delay tree.

20. (Original) The search method of claim 19 wherein generating a binary delay tree comprises generating a balanced binary delay tree.

21. (Original) The search method of claim 1 wherein receiving a signal having one or more signal images comprises receiving a first signal transmitted from a first antenna, said first signal having one or more signal images.

22. (Original) The search method of claim 21 further comprising:

receiving a second signal transmitted from a second antenna, said second signal having one or more signal images;

generating a second hierarchical delay tree for the second signal;

searching through both delay trees to identify a set of surviving delay nodes associated with the first and second signals; and

selecting one or more surviving delay nodes from the set of surviving delay nodes as the candidate delays associated with the first and second signals.

23. (Original) The search method of claim 1 wherein receiving a signal having one or more signal images comprises receiving the signal at first and second receive antennas.

24. (Original) The search method of claim 23 further comprising combining signal characteristics measured at the first and second receive antennas into a composite characteristic, wherein generating a hierarchical delay tree comprises generating a hierarchical delay tree for the composite characteristic.

25. (Original) The search method of claim 23 wherein generating the hierarchical delay tree comprises generating a first hierarchical delay tree for the signal delays associated with the first receive antenna and generating a second hierarchical delay tree for the signal delays associated with the second receive antenna.

26. (Original) The search method of claim 25 wherein searching through the delay tree comprises searching through the first delay tree to identify one or more surviving delay nodes associated with the first receive antenna and searching through the second delay tree to identify one or more surviving delay nodes associated with the second receive antenna.

27. (Original) The search method of claim 1 wherein the receiver is a RAKE receiver.

28. – 38 Cancel

39. (Previously Presented) A method for selecting one or more finger delays for a RAKE receiver comprising:

receiving a signal having one or more signal images, each signal image having a corresponding signal delay;

generating a hierarchical delay tree comprising a plurality of delay nodes in a lowermost level of the delay tree linked by branches and one or more linking nodes to a root node at the highest level of the delay tree, wherein each delay node is associated with a signal delay;

searching through the delay tree to identify one or more surviving delay nodes, wherein searching comprises traversing downward through the delay tree and identifying one or more surviving nodes at each level during said downward traversal by comparing a value associated with each node traversed with a predetermined threshold;

adding candidate delays corresponding to the surviving delay nodes to a candidate pool; and

selecting one or more finger delays for the RAKE receiver from the candidate pool.

40. (Original) The method of claim 39 wherein generating a hierarchical delay tree comprises:

determining a signal characteristic for one or more signal delays;

assigning a value based on the signal characteristics to the delay nodes;

assigning a value to each linking node equal to the sum of the nodes in the next lower level connected by branches to the linking node; and

assigning a value to the root node equal to the sum of the linking nodes at the level below the root node connected by branches to the root node.

41. (Original) The method of claim 40 wherein determining the signal characteristic for one or more signal delays comprises determining a signal energy associated with the one or more signal delays.

42. (Original) The method of claim 40 wherein determining the signal characteristics for one or more signal delays comprises determining a signal-to-noise ratio associated with the one or more signal delays.

43. Cancel

44. (Previously Presented) The method of claim 39 wherein the predetermined threshold comprises a level-specific threshold for each level of the delay tree.

45. (Previously Presented) The method of claim 39 further comprising:

identifying non-surviving nodes at each level of the delay tree; and

deleting subtrees depending from the non-surviving nodes such that the subsequent searches through the lower levels of the delay tree do not include the deleted subtrees.

46. (Previously Presented) The method of claim 39 wherein searching through the delay tree to identify one or more surviving delay nodes further comprises repetitively searching through the delay tree until a desired number of candidates delays are identified.

47. (Previously Presented) The method of claim 46 wherein repetitively searching through the delay tree until a desired number of candidates delays are identified further comprises increasing the predetermined threshold in a repeat search relative to an initial search to reduce the number of candidate delays identified.

48. (Original) The method of claim 47 wherein repetitively searching through the delay tree until a desired number of candidates delays are identified further comprises limiting the repeat search to subtrees depending from surviving nodes in the previous search.

49. (Previously Presented) The method of claim 46 wherein repetitively searching through the delay tree until a desired number of candidates delays are identified further comprises decreasing the predetermined threshold in a repeat search relative to an initial search to increase the number of candidate delays identified.

50. (Original) The method of claim 49 wherein repetitively searching through the delay tree until a desired number of candidates delays are identified further comprises limiting the repeat search to subtrees depending from non-surviving nodes in the previous search.

51. (Original) The method of claim 39 wherein adding the candidate delays corresponding to the surviving delay nodes to the candidate pool comprises inputting the candidate delays corresponding to the surviving delay nodes into a state machine, said state machine comprising a plurality of ordered states including a start state, a steady state, and an exit state.

52. (Original) The method of claim 51 further comprising assigning one or more candidate delays in one or more states of the state machine to respective RAKE fingers.

53. (Original) The method of claim 52 wherein assigning one or more candidate delays in one or more states of the state machine to respective RAKE fingers comprises assigning one or more candidate delays in the steady state to respective RAKE fingers.

54. (Original) The method of claim 51 further comprising promoting and demoting candidate delays present in the state machine responsive to the results of searching through the delay tree.

55. (Original) The method of claim 54 wherein promoting and demoting candidate delays present in the state machine responsive to the results of searching through the delay tree comprises promoting candidate delays in the state machine from a first state to a second state when the candidate delay corresponds to a surviving delay node.

56. (Original) The method of claim 54 wherein promoting and demoting candidate delays present in the state machine responsive to the results of searching through the delay tree comprises demoting candidate delays present in the state machine from a first state to a second state when the candidate delay corresponds to a non-surviving delay node.

57. (Original) The method of claim 51 further comprising deleting one or more candidate from the state machine responsive to the results of searching through the delay tree.

58. (Previously Presented) A delay searcher for a receiver to search a received signal having a plurality of signal images corresponding to a plurality of signal delays for one or more candidate delays, the delay searcher comprising:

a tree generator to generate a hierarchical delay tree comprising:

a plurality of delay nodes in a lowermost level of the delay tree, wherein each delay node is associated with a signal delay;

a root node at the highest level of the delay tree;

one or more linking nodes disposed between the root node and the plurality of delay nodes; and

branches that link the plurality of delay nodes to the root node via the linking nodes; and

a tree searcher to search through the delay tree to identify one or more surviving delay nodes, wherein the one or more surviving delay nodes correspond to the one or more candidate delays, and wherein the tree searcher traverses downward through the delay tree to identify one or more surviving nodes at each level during said downward traversal by comparing a value associated with each node traversed with a predetermined threshold.

59. Cancel

60. (Previously Presented) The delay searcher of claim 58 wherein the tree generator determines the predetermined threshold by determining a level threshold for each level of the delay tree.

61. (Original) The delay searcher of claim 60 wherein the tree searcher searches through the delay tree by comparing the nodes at one or more levels to the corresponding level threshold and identifying the nodes that meet or exceed the level threshold as the surviving nodes.

62. (Original) The delay searcher of claim 61 wherein the tree searcher further identifies non-surviving nodes at each level of the delay tree and deletes subtrees depending from the non-surviving delay nodes such that subsequent searches through the lower levels of the delay tree do not include the deleted subtrees.

63. (Original) The delay searcher of claim 60 wherein the tree searcher repeatedly searches through the delay tree until a desired number of candidate delays are identified.

64. (Original) The delay searcher of claim 63 wherein the tree searcher increases the level thresholds in a repeat search relative to an initial search to reduce the number of candidate delays identified.

65. (Original) The delay searcher of claim 64 wherein the tree searcher limits the repeat search to subtrees depending from surviving nodes in the previous search.

66. (Original) The delay searcher of claim 63 wherein the tree searcher decreases the level thresholds in a repeat search relative to an initial search to increase the number of candidate delays identified.

67. (Original) The delay searcher of claim 66 wherein the tree searcher limits the repeat search to subtrees depending from non-surviving nodes in the previous search.

68. (Original) The delay searcher of claim 58 further comprising a state machine comprising a plurality of ordered states including a start state, an exit state, and a steady state.

69. (Original) The delay searcher of claim 68 wherein the state machine promotes and demotes candidate delays present in the state machine responsive to the results from the tree searcher.

70. (Original) The delay searcher of claim 69 wherein the state machine promotes candidate delays in the state machine from a first state to a second state when the candidate delay corresponds to a surviving delay node

71. (Original) The delay searcher of claim 69 wherein the state machine demotes candidate delays in the state machine from a first state to a second state when the candidate delay corresponds to a non-surviving delay node.

72. (Original) The delay searcher of claim 68 wherein the state machine deletes one or more candidate delays from the exit state responsive to the results from the tree searcher.

73. (Original) The delay searcher of claim 58 wherein the tree generator assigns a value to each linking node equal to the sum of the nodes in the next lower level connected by branches to the linking node, and wherein the tree generator assigns a value to the root node equal to the sum of the linking nodes at the level below the root node connected by branches to the root node.

74. (Original) The delay searcher of claim 58 wherein the received signal comprises a signal received at first and second receive antennas.

75. (Original) The delay searcher of claim 74 further comprising first and second state machines comprising a plurality of ordered states including a start state, an exit state, and a

steady state, wherein the first state machine receives the candidate delays associated with the first receive antenna and wherein the second state machine receives the candidate delays associated with the second receive antenna.

76. (Original) The delay searcher of claim 74 wherein the tree generator generates the hierarchical delay tree for the signal delays associated with the first receive antenna and wherein the tree searcher identifies one or more surviving delay nodes corresponding to the one or more candidate delays associated with the first receive antenna, the delay searcher further comprising:

a second tree generator to generate a second hierarchical delay tree for the signal delays associated with the second receive antenna; and

a second tree searcher to search through the second delay tree to identify one or more surviving delay nodes, wherein the one or more surviving delay nodes correspond to one or more candidate delays associated with the second receive antenna.

77. (Original) The delay searcher of claim 76 further comprising first and second state machines comprising a plurality of ordered states including a start state, an exit state, and a steady state, wherein the first state machine receives the candidate delays associated with the first receive antenna and wherein the second state machine receives the candidate delays associated with the second receive antenna.

78. (Original) The delay searcher of claim 76 further comprising:

a combiner to combine the candidate delays associated with the first and second receive antennas into a composite set of candidate delays; and

a state machine comprising a plurality of ordered states including a start state, an exit state, and a steady state, to receive the composite set of candidate delays.

79. (Original) The delay searcher of claim 78 wherein the combiner comprises an OR-gate.

80. (Original) The delay searcher of claim 78 wherein the combiner comprises an AND-gate.

81. – 87. Cancel

88. (Previously Presented) A RAKE receiver in a wireless network comprising:

a front end receiver for receiving a signal having one or more signal images, each signal image having a corresponding signal delay;

a delay searcher to generate and search through a hierarchical delay tree based on delay nodes associated with the signal delays to identify one or more surviving delay nodes, wherein each surviving delay node corresponds to a candidate delay, and wherein the tree searcher traverses downward through the delay tree to identify the one or more surviving nodes at each level during said downward traversal by comparing a value associated with each node traversed with a predetermined threshold; and

wherein the RAKE receiver selects one or more RAKE finger delays from the candidate delays.

89. (Original) The RAKE receiver of claim 88 wherein the delay searcher comprises a tree generator to generate the hierarchical delay tree, said hierarchical delay tree comprising:

a plurality of delay nodes in a lowermost level of the delay tree, wherein each delay node is associated with a signal delay;

a root node at the highest level of the delay tree;

one or more linking nodes disposed between the root node and the plurality of delay nodes; and

branches that link the plurality of delay nodes to the root node via the linking nodes.

90. (Original) The RAKE receiver of claim 89 further comprising an energy estimator to determine a signal characteristic for one or more signal delays, wherein the tree generator assigns a value based on the signal characteristics to each delay node.

91. (Original) The RAKE receiver of claim 90 wherein the signal characteristic comprises a signal energy associated with the signal delay.

92. (Original) The RAKE receiver of claim 89 wherein tree generator assigns a value to each linking node equal to the sum of the nodes in the next lower level connected by branches to the linking node, and wherein the tree generator assigns a value to the root node equal to the sum of the linking nodes at the level below the root node connected by branches to the root node.

93. Cancel

94. (Previously Presented) The RAKE receiver of claim 88 wherein the delay searcher determines the predetermined threshold by determining a level threshold for each level of the delay tree.

95. (Previously Presented) The RAKE receiver of claim 94 wherein the tree searcher identifies the nodes that meet or exceed the level threshold as the surviving nodes.

96. (Original) The RAKE receiver of claim 95 wherein the tree searcher further identifies non-surviving nodes at each level of the delay tree and deletes subtrees depending from the non-surviving delay nodes such that subsequent searches through the lower levels of the delay tree do not include the deleted subtrees.

97. (Original) The RAKE receiver of claim 94 wherein the tree searcher repeatedly searches through the delay tree until a desired number of candidate delays are identified.

98. (Original) The RAKE receiver of claim 97 wherein the tree searcher changes the level thresholds in a repeat search to identify a fewer or greater number of candidate delays.

99. (Original) The RAKE receiver of claim 98 wherein the tree searcher increases the level thresholds in the repeat search relative to an initial search to reduce the number of candidate delays identified.

100. (Original) The RAKE receiver of claim 99 wherein the tree searcher limits the repeat search to subtrees depending from surviving nodes in the previous search.

101. (Original) The RAKE receiver of claim 98 wherein the tree searcher decreases the level thresholds in the repeat search relative to an initial search to increase the number of candidate delays identified.

102. (Original) The RAKE receiver of claim 101 wherein the tree searcher limits the repeat search to subtrees depending from non-surviving nodes in the previous search.

103. (Original) The RAKE receiver of claim 88 further comprising a state machine comprising a plurality of ordered states including a start state, an exit state, and a steady state, wherein said state machine receives the candidate delays corresponding to the surviving delay nodes.

104. (Original) The RAKE receiver of claim 103 wherein the state machine promotes and demotes candidate delays present in the state machine responsive to the results from the delay searcher.

105. (Original) The RAKE receiver of claim 104 wherein the state machine promotes candidate delays in the state machine from a first state to a second state when the candidate delay corresponds to a surviving delay node

106. (Original) The RAKE receiver of claim 104 wherein the state machine demotes candidate delays in the state machine from a first state to a second state when the candidate delay corresponds to a non-surviving delay node.

107. (Original) The RAKE receiver of claim 103 wherein the state machine deletes one or more candidate delays responsive to the results from the tree searcher.

108. (Original) The RAKE receiver of claim 88 wherein the front-end receiver receives a first signal transmitted from a first antenna, said first signal having one or more signal images.

109. (Original) The RAKE receiver of claim 108 wherein the front-end receiver receives a second signal transmitted from a second antenna, said second signal having one or more signal images, and wherein the delay searcher generates a second hierarchical delay tree based on delay nodes associated with the signal delays of the second signal.

110. (Original) The RAKE receiver of claim 109 wherein the delay searcher searches through both delay trees to identify a set of surviving delay nodes associated with the first and second signals and selects one or more surviving delay nodes from the set of surviving delay nodes as the candidate delays associated with the first and second signals.

111. (Original) The RAKE receiver of claim 88 wherein the front-end receiver receives the signal at first and second receive antennas.

112. (Original) The RAKE receiver of claim 111 further comprising a combiner to combine signal characteristics received at the first and second receive antennas into a composite characteristic, wherein the delay searcher generates a hierarchical delay tree for the composite characteristic.

113. (Original) The RAKE receiver of claim 111 further comprising first and second state machines comprising a plurality of ordered states including a start state, an exit state, and a steady state, wherein the first state machine receives the candidate delays associated with the first receive antenna and wherein the second state machine receives the candidate delays associated with the second receive antenna.

114. (Original) The RAKE receiver of claim 111 wherein the delay searcher further comprises:

a first tree generator to generate a first hierarchical delay tree for the signal delays associated with the first receive antenna;

a first tree searcher to search through the first delay tree and identify one or more surviving delay nodes associated with the first receive antenna;

a second tree generator to generate a second hierarchical delay tree for the signal delays associated with the second receive antenna; and

a second tree searcher to search through the second delay tree to identify one or more surviving delay nodes associated with the second receive antenna.

115. (Original) The RAKE receiver of claim 114 further comprising first and second state machines comprising a plurality of ordered states including a start state, an exit state, and a steady state, wherein the first state machine receives the candidate delays associated with the first receive antenna and wherein the second state machine receives the candidate delays associated with the second receive antenna.

116. (Original) The RAKE receiver of claim 114 further comprising:

a combiner to combine the candidate delays associated with the first and second receive antennas into a composite set of candidate delays; and

a state machine comprising a plurality of ordered states including a start state, an exit state, and a steady state, to receive the composite set of candidate delays.

117. (Original) The RAKE receiver of claim 116 wherein the combiner comprises an OR-gate.

118. (Original) The RAKE receiver of claim 116 wherein the combiner comprises an AND-gate.

119. (Previously Presented) A circuit for processing a received signal having one or more signal images, each signal image having a corresponding signal delay, the circuit comprising search circuitry to generate and search through a hierarchical delay tree based on delay nodes associated with the signal delays to identify one or more surviving delay nodes, wherein each surviving delay node corresponds to a candidate delay, and wherein the search circuitry traverses downward through the hierarchical delay tree to identify one or more surviving nodes at each level during said downward traversal by comparing a value associated with each node traversed with a predetermined threshold.

120. (Original) The circuit of claim 119 wherein the search circuitry includes tree generation circuitry to generate the hierarchical delay tree, said hierarchical delay tree comprising:

a plurality of delay nodes in a lowermost level of the delay tree, wherein each delay node is associated with a signal delay;

a root node at the highest level of the delay tree;

one or more linking nodes disposed between the root node and the plurality of delay nodes; and

branches that link the plurality of delay nodes to the root node via the linking nodes.

121. Cancel

122. (Previously Presented) The circuit of claim 119 wherein the search circuitry determines the predetermined threshold by determining a level threshold for each level of the delay tree.

123. (Previously Presented) The circuit of claim 122 wherein the search circuitry identifies the nodes that meet or exceed the level threshold as the surviving nodes.

124. (Original) The circuit of claim 123 wherein the search circuitry further identifies non-surviving nodes at each level of the delay tree and deletes subtrees depending from the non-surviving delay nodes such that subsequent searches through the lower levels of the delay tree do not include the deleted subtrees.

125. (Original) The circuit of claim 119 wherein the search circuitry repeatedly searches through the delay tree until a desired number of candidate delays are identified.